

Amendment After Final Rejection
Application No. 10/718,751
Attorney Docket No. 062829

REMARKS

Upon entry of the above amendments, claims 1, 3 and 5-8 will be pending. Applicants propose amendment of claims 1 and 8 and cancellation of claim 4 due to its incorporation into claim 1 and claim 8. The dependencies of claims 5 and 6 are also amended due to cancellation of claim 4. Since the amendments do not raise new issues after final rejection, entry thereof is earnestly solicited.

Claim 8 has been withdrawn from further consideration as being directed to a non-elected invention. However, the Examiner is requested to consider rejoinder of claim 8 upon allowance of the elected claims.

Claim 1 and 3 were rejected under 35 USC § 103(a) as being unpatentable over Doane et al. in view of Rademacher et al. This rejection has been rendered moot by the above-noted amendment in which the features of claim 4 have been incorporated into claim 1.

Claim 4 was rejected under 35 USC § 103(a) as being unpatentable over Doane et al. in view of Rademacher et al. and further in view of Ikeda et al.; claims 5 and 7 were rejected under 35 USC § 103(a) as being unpatentable over these references further in view of Kubota et al.; and claim 6 was rejected under 35 USC § 103(a) as being unpatentable over Doane et al. in view of Rademacher et al. and Ikeda et al. and further in view of Ozawa et al. and Watanabe et al. Favorable reconsideration of these rejections is earnestly solicited.

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In the flexible hose comprising a metal bellows tube of the present invention, it is preferred that the pitch between the peaks of the corrugated structure is narrow for improving durability of the hose. However, the reduction of pitch between the peaks hinders filling up of the valleys (channels) of the corrugated structure with the rubber composition, which leads to deterioration of interlaminer adhesion between the metal bellows tube and the first rubber layer and shift of the contact face of the metal bellows tube relative to the rubber layer. The present invention solves this contradictory problem. Specifically, for filling the channel having peaks disposed with an extremely narrow pitch of 0.1 to 1 mm (extremely narrow opening for filling rubber composition) and a valley portion having a width greater than the pitch, the present invention selects the rubber composition including a rubber of an acryl group and a compound of a resorcinol group and having a Mooney viscosity (MV) of between 15 and 45 at 100°C. This rubber composition can be sufficiently filled through the narrow opening of the channel into the broader valley portion so as to evenly distribute rubber composition throughout the channel, thereby improving the interlaminer adhesion between the metal bellows tube and the rubber layer formed of this rubber composition as well as durability of the hose.

The present invention was limited by adding the limitation that a rubber composition including a rubber of an acryl group and a compound of a resorcinol group is selected for forming a first rubber layer (original claim 4). The composition including a rubber of an acryl group and a compound of a resorcinol group has excellent adhesive effects as compared to the composition including EPDM and a compound of a resorcinol group, as clearly shown by

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comparing Examples 1 and 2 of the present invention. Specifically, materials for forming the first layer (Intermediate Rubber Layer) of the flexible hose of Example 1 include a rubber of an acrylic group and a compound of a resorcinol group, while materials for forming the first layer of the flexible hose of Example 2 include EPDM and a compound of a resorcinol group. As shown in Table 1, the adhesion strength of Example 1 including a rubber of an acrylic group and a compound of a resorcinol group was 2.8 kg/ 25 mm, while that of Example 2 was 2.5 kg/25 mm, that is, the adhesion strength of Example 2 is lower than that of Example 1 by more than 10 %. Therefore, the rubber composition of the invention including a rubber of an acrylic group and a compound of a resorcinol group is superior in adhesion strength to a rubber composition including EPDM and a compound of a resorcinol group by more than 10%.

The present invention is characterized by the structures that each channel has peaks disposed with a narrow pitch of 0.1 to 1.0 mm and a valley portion below the peaks having a width greater than the pitch; for filling the channel, a rubber composition including a rubber of an acryl group and a compound of a resorcinol group is used; and a Mooney viscosity (MV) of the rubber composition is adjusted to between 15 and 45. Although Doan et al. (USP 2,449,369) discloses a structure comprising a metal bellows tube and a first rubber layer formed on the outer circumference of the metal bellows tube, this reference does not disclose the structures of the channel, a rubber composition including a rubber of an acryl group and a compound of a resorcinol group, and having a Mooney viscosity (MV) of between 15 and 45 at 100°C of the present invention.

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Rademacher et al. (US 2004/0242780 A1) discloses a composition including EPDM. (Paragraph [0019]) as a rubber cement for forming the first rubber layer as taught by Doane et al., and a combination of acrylic rubber with EPDM (Paragraph [0021]). With regard to the viscosity, although Rademacher et al. discloses that the rubber cement including EPDM had a Mooney viscosity of $ML_{1+4} @ 100^{\circ}\text{C}$ of about 35, the reference does not disclose a viscosity of a rubber composition including a rubber of an acryl group and a compound of a resorcinol group. Therefore, Rademacher et al. does not disclose the viscosity of the rubber composition of the present invention.

Ikeda et al. (US 2002/0074050 A1) discloses a hose comprising a metal bellows and a rubber layer formed on the outer periphery of the metal bellows, wherein the rubber layer is formed of a rubber composition including EPDM and a resorcinol compound (Paragraphs [0007] to [0014], [0029], [0080]). Although Ikeda et al. discloses the rubber composition including EPDM and a resorcinol compound, the reference does not disclose the structure of the present invention, namely, the combination of a rubber of an acryl group and a compound of a resorcinol group. In other words, even if the references are combined, the combination does not teach all the features of the claimed invention.

As described above, according to the present invention, in a flexible hose comprising a metal corrugated tube and a first rubber layer formed on the outer circumference thereof, even if the pitch of peaks of the corrugated structure are reduced and the opening of a channel defined below the peaks is narrowed so as to improve durability of the hose with maintaining

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retractability of the corrugated structure, a rubber composition is allowed to be sufficiently filled through the narrow opening into a valley portion of the channel having a broader width than the opening so as to be evenly distributed throughout the channel. Since the channel has a configuration in which the peaks of the channel are disposed with an extremely narrow pitch of 0.1 to 1.0 mm and a valley portion below the peaks has a width greater than the pitch, the rubber composition of the invention includes a rubber of an acryl group and a compound of a resorcinol group and has a Mooney viscosity of between 15 and 45 at 100°C, so that the channel is filled up with the rubber composition through the narrow opening into the bottom of the broader valley portion, thereby drastically improving the interlaminer adhesion between the metal corrugate tube and the durability of the hose.

In contrast, a rubber composition including a resorcinol compound and EPDM as disclosed by the prior art cannot achieve the adhesive strength associated with the present invention. As described above, this is clearly shown by comparing Example 1 (a combination of a rubber of an acryl group and a compound of a resorcinol group which had an adhesion strength of 2.8 kg/25 mm) and Example 2 (a combination of EPDM and a compound of a resorcinol group which had an adhesion strength of 2.5 kg/25 mm) of the present invention.

The teachings of Kubota et al., Ozawa et al. and Watanabe et al. fail to provide the teachings which the primary references lack.

For at least the foregoing reasons, the claimed invention distinguishes over the cited art and defines patentable subject matter. Favorable reconsideration is earnestly solicited.

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Should the Examiner deem that any further action by applicants would be desirable to place the application in condition for allowance, the Examiner is encouraged to telephone applicants' undersigned attorney.

If this paper is not timely filed, Applicants respectfully petition for an appropriate extension of time. The fees for such an extension or any other fees that may be due with respect to this paper may be charged to Deposit Account No. 50-2866.

Respectfully submitted,

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